Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/2
CANADA
February 1964
Original: ENGLISH

Confidential until official release during Conference

Abstract

UTILIZATION OF CANADIAN RESEARCH REACTORS

D. G. Hurst, R. E. Manson, E. Critoph
Chalk River Nuclear Laboratories,
Atomic Energy of Canada Limited, Chalk River, Ontario
and
H. E. Petch
McMaster University, Hamilton, Ontario

1. In Canada there are three high-flux reactors: the heavy-water-moderated reactors NRX and NRU at the Chalk River Nuclear Laboratories, and the McMaster Nuclear Reactor at McMaster University.

2. NRX is a 40-MW reactor with a maximum thermal-neutron flux of 10^{14} cm^{-2} s^{-1}. The basic fuel was recently changed from uranium metal to uranium dioxide with enrichment spikes. This increased the flux by 40%, extended the fuel lifetime, and provided a large-scale test of UO_2. The transition was made without interrupting the full utilization of the reactor. Many modifications have been made to the NRX system since the start-up in 1947. The control methods have been modified several times to keep pace with improved technology. The power has been raised and the structure has been altered to accommodate loops. NRU has been in operation since 1957 and is now being converted to a fully enriched reactor for operation at the same flux level as before (3×10^{14} cm^{-2} s^{-1}), but at a power of 60 MW instead of the previous 220 MW.

3. For the development of economic nuclear power, a matter of primary interest in the Canadian program, fuel and material tests are essential. NRX has seven high-pressure, high-temperature loops for such tests with various coolants (water, boiling water, fog, steam, and organic fluid) and one low-pressure low-temperature loop for studying problems of moderator chemistry; in NRU two of the three core positions designed for loops have been used. Fundamental research in physics, chemistry and biology is another major interest, and the intense neutron fluxes have opened new areas of investigation. About twenty-five horizontal holes through the reactor shields are in use for experiments. Radioisotopes, especially ^{60}Co, are produced on a commercial basis as well as for research. Other papers at this Conference describe in more detail the research and development done with these facilities.

4. The wide variety of work at the Chalk River reactors requires many supporting services and facilities, with a well-integrated organization and good liaison between the scientists, engineers and works personnel. Over the years the accumulation of operating experience has resulted in the development of procedures for the efficient use of the reactors. Full use is made of modern computer techniques for scheduling maintenance and other work during shutdown. Many reactor operators from Canada and other countries have been trained on NRX and NRU.

5. The McMaster Nuclear Reactor, a 1-MW pool reactor operated by McMaster University, represents a different scale of operation appropriate to teaching institutions. The installation provides a thermal column, six beam ports and a pneumatic rabbit system. Associated facilities include a hot cell, a gamma irradiation room and a fast-neutron generator. The research, mainly fundamental in nature, is being done by members of the departments of biology, chemistry, chemical engineering, geology, medical research, mechanical engineering, metallurgy and physics. It has proved possible to provide for the university research program with a small operating staff and simple organization.